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10/597,739	08/04/2006	Ali S. Sadri	P17140/1020.P17140	5587
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/597,739

Applicant(s)

SADRI ET AL.

Examiner

ADNAN BAIG

Art Unit

2416

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 July 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7 and 9-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7 and 9-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB-08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-5, 7, and 9-17, are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1 and the remaining independent claims, lines (7-8) of the claim cites "*filtered data streams having substantially similar equal impulse responses*". It is ambiguous with regard to whether the impulse responses are equal or substantially similar because either the responses must be equal (i.e., exact), or substantially similar. Also, it is unclear to what extent the impulse responses are "substantially similar". Appropriate correction is required.

Lines (9-10) of the claim cite, "*a plurality of equalizers having substantially similar equalization parameters*". It is unclear to what extent the term "substantially similar" corresponds to for each of a plurality of equalizers. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-5, 7, 9-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ketchum et al. (US 2003/0185310) in view of Kim (US 2006/0159160).

Regarding Claim 1, Ketchum discloses a method, comprising:
estimating a channel impulse response matrix, **(see Para [0080-0081])**
creating a crosstalk suppression filter matrix based on said channel impulse response matrix, **(see Para [0007] Lines 3-11 & Fig. 1 which illustrates the impulse response for the received symbol vector $r(n)$ wherein a noise vector $Z(n)$ is processed at the receiver, and is transmitted through a suppression filter 170).**

filtering a plurality of data streams received over a channel for a multiple input multiple output system **(see Fig. 1 & Para [0031])** to reduce far end cross talk between said data streams using said crosstalk suppression filter matrix **(see Fig. 1 item 170)** to form filtered data streams, **(see Para [0007] see Lines 7-18 & Para [0034]).**

said filtered data streams having substantially similar equal impulse responses,
(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector $r(n)$ [0031], where $r(n)$ is filtered through filter 172. Ketchum teaches a corresponding equal matched filter for each individual set of plurality data streams which

outputs equal impulse responses for each data stream that is filtered, [0040-0043]).

equalizing said filtered data streams **(see Para [0007], lines 7-15)**

Ketchum does not disclose equalizing said filtered data streams using a plurality of equalizers having substantially similar equalization parameters, wherein the number of equalizers corresponds to the number of filtered data streams, however the limitation is known in the art of communications by evidence of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through Bank "M-1", each containing a filter for each receive antenna. The receive antenna receives and equalizes transmit signals (**data streams**) corresponding from each transmit antenna **(see Fig. 1B)** in a MIMO system, **(See Para [0041] & [0046])**.

Kim discloses the number of equalizer banks corresponds to the number of data streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053]**.

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown in Fig. 2B, have substantially similar equalization parameters (**i.e., filter coefficients**) because they all calculate **(see fig. 3, step 312)** their respective filter coefficients **(Fig.**

2B, Filter coefficient 252) based on a computed channel coefficient and noise covariance to determine their respective filter coefficients, (**see Para [0054]**).

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in performance, peak throughput, and can provide diversity against deleterious path effects (i.e., multi-path), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system by reusing spreading codes in different transmit antennas, (**see Para [0010]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include a plurality of equalizers having substantially similar equalization parameters to equalize data streams, wherein the number of equalizers corresponds to the number of data streams at taught by Kim, for a plurality of filtered data streams from a crosstalk suppression filter matrix based on estimating a channel impulse response matrix as taught by Ketchum, because the teaching lies in Kim that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 2, the combination of Ketchum in view of Kim disclose, the method of claim 1, wherein said channel impulse response matrix and said crosstalk suppression filter matrix have a substantially similar structure and matrix dimension, **[0042] see**

lines 1-7 (Ketchum describes the filter as in claim 1, matched to the impulse response in the equivalent channel).

(In paragraph [0044] Ketchum discloses a formula that shows that the matrices of said channel impulse response and suppression filter are equal. Paragraphs [0045-0048] discuss the properties of said channel impulse response and suppression filter).

Regarding Claim 3, the combination of Ketchum in view of Kim disclose the method of claim 1, wherein said estimating comprises:

estimating at least one channel characteristic for said channel, **(see Para [0112] & [0081] i.e., (channel impulse response is estimated i.e., characteristic)**

approximating a plurality of channel impulse response values based on said channel characteristic, **(See Para [0020]).**

creating said channel impulse response matrix using said channel impulse response values, **(See Para [0018-0022]).**

Regarding Claim 4, the combination of Ketchum in view of Kim disclose, the method of claim 1, wherein said creating comprises:

transposing said channel impulse response matrix, **([0042])**

substituting each element of said transposed channel impulse response matrix with its minor element; **(Substituting each element of said CIR matrix with its minor element is interpreted as convolution in the claim with respect to the applicant's specification. The paragraph teaches convolution being performed on said transposed channel impulse response matrix, [0114]).**

determining a sign for each minor element, **(Determining a sign for each minor element is interpreted as convolution values in the claim with respect to the applicant's specifications. The paragraphs cited, determine the order for the convolution values or "minor element" based on the values sign, see Para ([0126] & [0127 lines 1-5]).**

Regarding Claim 5, the combination of Ketchum in view of Kim, disclose the method of claim 1, wherein each data stream comprises an inter-symbol interference signal, **(see Para [0036])**

Regarding Claim 7, Ketchum discloses a multiple input multiple output system, comprising:

a communications medium; a plurality of transmitters to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel; a plurality of receivers to

connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel, [0007] (Ketchum illustrates a MIMO system in Fig. 3 where section 300 illustrates the plurality of transmitters and receivers connected to communications medium 310).

a crosstalk filtering module to connect to said plurality of receivers, said crosstalk filtering module to filter said data streams (see Para [0007] see Lines 7-18) to reduce far end crosstalk noise incurred by said data streams during said transmission to form filtered data streams, (Referring to Fig. 1 section 170, Ketchum illustrates a crosstalk filtering module connected to the receivers of said MIMO system [0034] see Lines 1-9).

said filtered data streams having substantially similar equal impulse responses, (Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector $r(n)$ [0031], where $r(n)$ is filtered through filter 172. Ketchum teaches a corresponding equal matched filter for each individual set of plurality data streams which outputs equal impulse responses for each data stream that is filtered, [0040-0043]).

Ketchum does not disclose a plurality of equalizers to connect to said crosstalk filtering module, said plurality of equalizers having substantially similar equalization parameters to equalize said filtered data streams, wherein the number of equalizers corresponds to

the number of filtered data streams, however the limitation is known in the art of communications by evidence of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through Bank "M-1", each containing a filter for each receive antenna. The receive antenna receives and equalizes transmit signals (**data streams**) corresponding from each transmit antenna (**see Fig. 1B**) in a MIMO system, (**See Para [0041] & [0046]**).

Kim discloses the number of equalizer banks corresponds to the number of data streams from the M transmit antennas 114 of Fig. 1B, **see Para [0049-0053]**.

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown in Fig. 2B, have substantially similar equalization parameters (**i.e., filter coefficients**) because they all calculate (**see fig. 3, step 312**) their respective filter coefficients (**Fig. 2B, Filter coefficient 252**) based on a computed channel coefficient and noise covariance to determine their respective filter coefficients, (**see Para [0054]**).

Kim teaches multiple transmit and receive antennas (**i.e., MIMO**) are effective in performance, peak throughput, and can provide diversity against deleterious path effects (**i.e., multi-path**), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system by reusing spreading codes in different transmit antennas, **(see Para [0010])**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include a plurality of equalizers having substantially similar equalization parameters to equalize data streams, wherein the number of equalizers corresponds to the number of data streams at taught by Kim, for a plurality of filtered data streams from a crosstalk suppression filter matrix based on estimating a channel impulse response matrix as taught by Ketchum, in order to connect the plurality of equalizers to a crosstalk filtering module because the teaching lies in Kim that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 9, the combination of Ketchum in view of Kim disclose the multiple input multiple output system of claim 7, further comprising a channel estimator to connect to said receivers, said channel estimator to estimate at least one channel characteristic for said channel, **(see Para [0112] & [0081] i.e., (channel impulse response is estimated i.e., characteristic)**

Regarding Claim 10, the combination of Ketchum in view of Kim disclose the multiple input multiple output system of claim 7, wherein said crosstalk filtering module comprises:
a channel impulse response matrix generator to generate a channel impulse response

matrix, [0040] (Referring to Fig.1, TX and RX MIMO processors which generate the channel impulse response matrix in the MIMO communication system as illustrated in Fig. 1).

(Paragraph [0112] discloses that the RX MIMO processor transmits or generates the estimated channel impulse response).

a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter matrix using said channel impulse response matrix; (see Para [0034] lines 1-6)
a filter to filter said data streams using said crosstalk suppression filter matrix, (see Para [0007] lines 7-18)

Regarding Claim 11, Kethum discloses an apparatus, comprising:

a plurality of receivers to receive a plurality of data streams transmitted over a communications channel, [0007] (Fig. 1 and Fig. 3) (Ketchum illustrates a MIMO system in Fig. 3 where section 300 illustrates the plurality of transmitters and receivers connected to communications medium 310).

a crosstalk filtering module to connect to said plurality of receivers, said crosstalk filtering module to filter said data streams to reduce far end crosstalk noise incurred by said data streams during said transmission to form filtered data streams, (Referring to Fig. 1, section 170 illustrates a crosstalk filtering module connecting to the receivers of said MIMO system). [0034] see Lines 1-9).

said filtered data streams having substantially similar equal impulse responses, **(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector $r(n)$ [0031], where $r(n)$ is filtered through filter 172. Ketchum teaches a corresponding equal matched filter for each individual set of plurality data streams which outputs equal impulse responses for each data stream that is filtered, [0040-0043]).**

Ketchum does not disclose a plurality of equalizers to connect to said crosstalk filtering module, said plurality of equalizers having substantially similar equalization parameters to equalize said filtered data streams, wherein the number of equalizers corresponds to the number of filtered data streams, however the limitation is known in the art of communications by evidence of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through Bank "M-1", each containing a filter for each receive antenna. The receive antenna receives and equalizes transmit signals (**data streams**) corresponding from each transmit antenna (**see Fig. 1B**) in a MIMO system, (**See Para [0041] & [0046]**).

Kim discloses the number of equalizer banks corresponds to the number of data streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053]**.

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown in Fig. 2B, have substantially similar equalization parameters (i.e., **filter coefficients**) because they all calculate (**see fig. 3, step 312**) their respective filter coefficients (**Fig. 2B, Filter coefficient 252**) based on a computed channel coefficient and noise covariance to determine their respective filter coefficients, (**see Para [0054]**).

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in performance, peak throughput, and can provide diversity against deleterious path effects (i.e., multi-path), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system by reusing spreading codes in different transmit antennas, (**see Para [0010]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include a plurality of equalizers having substantially similar equalization parameters to equalize data streams, wherein the number of equalizers corresponds to the number of data streams at taught by Kim, for a plurality of filtered data streams from a crosstalk suppression filter matrix based on estimating a channel impulse response matrix as taught by Ketchum, in order to connect the plurality of equalizers to a crosstalk filtering module because the teaching lies in Kim that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 12, the combination of Ketchum in view of Kim disclose the apparatus of claim 11, wherein said crosstalk filtering module comprises:

a channel impulse response matrix generator to generate a channel impulse response matrix, **[0040] (Referring to Fig. 1, TX and RX MIMO processors generate the channel impulse response matrix in the MIMO communication system. Paragraph [0112] discloses that the RX MIMO processor transmits or generates the estimated channel impulse response).**

a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter matrix using said channel impulse response matrix **(see Para [0034] see lines 1-6)**
a filter to filter said data streams using said crosstalk suppression filter matrix, **(see Para [0007] lines 7-18)**

Regarding Claim 13, the combination of Ketchum in view of Kim disclose the apparatus of claim 11, further comprising a channel estimator **(see Fig. 5, 112)** to connect to said receivers, said channel estimator to estimate at least one channel characteristic for said channel, **(see Para [0112] & [0081] i.e., (channel impulse response is estimated i.e., characteristic))**

Regarding Claim 14, the combination of Ketchum in view of disclose the apparatus of claim 13, wherein said channel impulse matrix generator is to connect to said channel

estimator, and said channel impulse matrix generator is to use said at least one channel characteristic for said channel to generate said channel impulse matrix, **(the channel estimator sends or generates an estimated channel impulse response matrix, [0112] see lines 1-5).**

Regarding Claim 15, Ketchum discloses an article of manufacture comprising:
a storage medium; said storage medium including stored instructions that, when executed by a processor **(see Para [0192-0193])**, result in

estimating a channel impulse response matrix, **(see Para [0080-0081])**

creating a crosstalk suppression filter matrix based on said channel impulse response matrix, **[0007] see Lines 3-11, (Fig. 1 illustrates the impulse response for the received symbol vector $r(n)$ wherein a noise vector $Z(n)$ which is processed at the receiver, and is transmitted through a suppression filter 170).**

filtering a plurality of data streams received over a channel for a multiple input multiple output system to reduce far end cross talk between said data streams using said crosstalk suppression filter matrix **(see Fig. 1 item 170)** to form filtered data streams, **(see Para [0007] Lines 13-18).**

said filtered data streams having substantially similar equal impulse responses, **(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector $r(n)$ [0031], where $r(n)$ is filtered through filter 172. Ketchum teaches a corresponding equal matched filter for each individual set of plurality data streams which outputs equal impulse responses for each data stream that is filtered, [0040-0043]).**
equalizing said filtered data streams **([0007] see lines 7-15)**

Ketchum does not disclose equalizing said filtered data streams using a plurality of equalizers have [sic] substantially similar equalization parameters, wherein the number of equalizers corresponds to the number of filtered data streams, however the limitation is known in the art of communications by evidence of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through Bank "M-1", each containing a filter for each receive antenna. The receive antenna receives and equalizes transmit signals (**data streams**) corresponding from each transmit antenna (**see Fig. 1B**) in a MIMO system, (**See Para [0041] & [0046]**).

Kim discloses the number of equalizer banks corresponds to the number of data streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053]**.

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown in Fig. 2B, have substantially similar equalization parameters (i.e., **filter coefficients**) because they all calculate (**see fig. 3, step 312**) their respective filter coefficients (**Fig. 2B, Filter coefficient 252**) based on a computed channel coefficient and noise covariance to determine their respective filter coefficients, (**see Para [0054]**).

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in performance, peak throughput, and can provide diversity against deleterious path effects (i.e., multi-path), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system by reusing spreading codes in different transmit antennas, (**see Para [0010]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include a plurality of equalizers having substantially similar equalization parameters to equalize data streams, wherein the number of equalizers corresponds to the number of data streams at taught by Kim, for a plurality of filtered data streams from a crosstalk suppression filter matrix based on estimating a channel impulse response matrix as taught by Ketchum, because the teaching lies in Kim that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 16, the combination of Ketchum in view of Kim disclose the article of

claim 15, wherein the stored instructions, when executed by a processor, further result in said estimating by estimating at least one channel characteristic for said channel, **(see Para [0112] & [0081] i.e., (channel impulse response is estimated i.e., characteristic)**

approximating a plurality of channel impulse response values based on said channel characteristic, **(See Para [0020])**

creating said channel impulse response matrix using said channel impulse response values. **(See Para [0018-0022]).**

Regarding Claim 17, the combination of Ketchum in view of Kim disclose the article of claim 15, wherein the stored instructions, when executed by a processor, further result in said creating by transposing said channel impulse response matrix, **(See Para [0042]).**

substituting each element of said transposed channel impulse response matrix with its minor element, **(Substituting each element of said CIR matrix with its minor element is interpreted as convolution in the claim with respect to the applicant's specification. The paragraph teaches convolution being performed on said transposed channel impulse response matrix, [0114]).**

determining a sign for each minor element, [0126] [0127 see lines 1-5]. (Determining a sign for each minor element is interpreted as convolution values in the claim with respect to the applicant's specifications. The paragraphs cited, determine the order for the convolution values or "minor element" based on the values sign).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADNAN BAIG whose telephone number is (571) 270-7511. The examiner can normally be reached on Mon-Fri 7:30m-5:00pm eastern Every other Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on 571-272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ADNAN BAIG/
Examiner, Art Unit 2416

/Huy D Vu/
Supervisory Patent Examiner, Art Unit 2416